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Effectiveness of a Proposed Training Program Based on the Caffarella Model in Developing Computational Thinking Teaching Skills and Financial Culture among Middle School Mathematics Teachers

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Abstract

The current study aimed to identify the effectiveness of a proposed training program based on the Caffarella model in developing computational thinking teaching skills and financial culture among middle school mathematics teachers. To achieve the study's objectives, the researcher prepared two tools consisting of observation cards to measure the level of computational thinking teaching skills and financial culture teaching skills. The first card contained (25) skills, with six of them being (analysis, abstraction, algorithmic thinking, pattern recognition, evaluation, and generalization). The second observation card focused on financial culture teaching skills (planning, implementation, and evaluation). The study sample included (55) male and female teachers who were selected purposefully during the second semester (2025 AD / 1446 AH). The results indicated the effectiveness of the training program and a correlation between the observation card for computational thinking teaching skills and financial culture teaching skills. Cohen's coefficient values were significantly high for all skills. There were statistically significant differences in computational thinking teaching skills and financial culture teaching skills based on the gender variable, favoring females. However, there were no statistically significant differences in the observation card for computational thinking teaching skills and financial culture teaching skills based on the educational qualification and years of experience variables. The study recommended preparing mathematics teachers to employ computational thinking skills and integrate the concepts of financial culture found in mathematics books, linking these to students' real-life situations and artificial intelligence in teaching, along with expanding professional development for mathematics teachers in the same field.

Keywords: *Training Program, Caffarella Model, Computational Thinking Teaching Skills, Financial Culture, Mathematics Teachers, Middle School.*

Introduction

The role of mathematics is prominent in the development and progress of nations and peoples, as it is one of the important and valuable subjects in real life. It serves as a measure of the advancement and sophistication of nations, occupying a leading position on a global scale (Khalil, 2016). Additionally, it is considered one of the curricula that fosters the development of thinking among students of various age groups due to its nature, which is conducive to enhancing cognitive abilities, as well as the challenges posed by its problems that stimulate their intelligence and the mental processes required (Al-Jamal, Mubarak, & Mousa, 2018; Hani, 2013). Mathematics is a tool for understanding the surrounding environment and for organizing and developing thought (Al-Awad, 2016). It is also an important field through which scientific knowledge is acquired, thereby enhancing comprehension (Al-Ghamdi, 2020). It contributes to the development of thinking as a key standard, as stated in the Principles and Standards document by the National Council of Teachers of Mathematics (NCTM, 2000). Among the life

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areas related to thinking and connected to the applications of mathematics is financial culture, which entails familiarity with basic financial concepts and the ability to apply these concepts to efficiently and effectively manage financial resources to achieve financial security (Ghazal & Barakat, 2020). This aligns with modern global trends that emphasize the importance of financial education for individuals as a requirement for sustainable human development, while enhancing the role of the curriculum through focusing on teaching and learning strategies that support financial culture (Zachary & Finney, 2018). It corresponds with the philosophy of integrated experiences between mathematics and other subjects and aligns with the overall trend toward financial education (Hassan, 2019). Thus, integrating financial culture skills with mathematics education in the classroom makes students feel the interconnectedness between the two subjects and the practicality of mathematics, beyond confining it to school applications only (Attard & Catherine, 2016). Moreover, the study by Khalo (2014) indicated that the errors made by students in problem-solving involving financial culture stem from the use of mathematical laws that do not align with financial problems. It recommended the importance of teaching mathematics through the application of mathematical laws in real-life financial problems.

Teaching financial culture is based on the Theory of Planned Behavior (TPB), which is a method for understanding why individuals decide to engage in particular behaviors. This theory indicates that a learner's decision to engage in a behavior, such as learning financial culture, is influenced by the teacher's attitude towards the behavior, their perception of whether students believe they should engage in the behavior, and their confidence in their ability to perform the behavior (Teo, Koh, & Lee, 2011). Additionally, it incorporates the theory of variation in learning, meaning that understanding basic financial concepts through varying and diverse patterns helps students develop a framework for assessing financial situations and greatly enhances their financial culture. Applying learning theories, such as the theory of variation in instruction, can lead to the retention and long-term understanding of financial concepts, as students learn to apply those concepts in new and diverse situations by focusing on core financial principles, such as the relationship between risk and return, and liquidity while teaching students, and this approach allows for a more effective presentation and analysis of financial situations, ultimately improving financial decision-making skills (Pang, 2016).

Thinking is a complex concept consisting of three components: complex cognitive processes such as problem-solving, and less complex ones like comprehension, application, and reasoning; specific knowledge related to the content and subject matter; and personal readiness and factors such as attitudes and tendencies (Jarwan, 2005). Thinking includes a range of skills mentioned by Al-Sha'er (2001), such as comparison, classification, organization, abstraction, generalization, tangible association, analysis, synthesis, and the ability to think, where it is considered a learned ability rather than an inherited trait and is associated with skills that can be learned and improved through training and practice (Bower & Falkner, 2015). Therefore, thinking skills are life skills that students practice daily and are essential for members of society.

As for the nature of computational thinking: Wing (2006) described it as the mental processes that involve framing problems and their solutions, including information processing followed by successful implementation. Denning (2009) defined it as the mental inclination to formulate a solution to problems by transforming certain inputs into outputs and searching for algorithms to perform those transformations. Wing (2016) added that it is the thinking processes involved in framing a problem and expressing its solution in a way that allows an individual to effectively think about its execution, similar to the approach of computer scientists. Aho (2012) defined computational thinking as the thought processes involved in formulating problems so that their solutions can be represented as computational steps and algorithms; it involves finding suitable computational models to frame the problem and deducing its solutions.

Computer thinking skills are among the requirements of the twenty-first century and are essential skills that students need to develop to help them solve the problems they encounter in life, due to their distinctive characteristics (Grover & Pea, 2018). The main features of computer thinking skills include: a focus on concepts rather than programming, thinking at high levels of abstraction, encompassing mathematical and geometric thinking, and being based on these areas. It emphasizes ideas rather than tools and focuses on computational concepts that can be used to address problems and their solutions (Wing, 2006). This is a way of human thinking rather than computer thinking, and it combines problem-solving and computing thinking, which means employing a high level of thinking to find solutions (Yadav, et al., 2017).

The researcher adds that the characteristics of computational thinking skills include the ability to formulate mathematical problems in a way that allows the use of computer methods to solve them, and to represent data through abstraction such as models, as well as to identify, analyze, and implement possible solutions that achieve the goal more efficiently and generalize problem solutions. Researchers agree that computational thinking skills encompass five core skills: (Peters-Burton, 2018; Angeli et al., 2016) algorithm, which includes a set of sequential steps that describe clearly all the necessary actions to solve a given problem; it consists of two skills: sequencing by determining actions in a correct order, and control flow by arranging the execution of necessary actions, such as establishing rules and conditions. Additionally, decomposition refers to breaking down and analyzing a complex problem into smaller problems to solve them and then assembling them to arrive at the solution to the main problem. Abstraction focuses on the primary issue while leaving out unimportant details, emphasizing the essential operations. Evaluation aims to ensure the efficiency and effectiveness of the solution steps in achieving the desired result. Generalization involves generalizing the solution for related or similar problems.

The importance of computational thinking skills is evident in every field of life, highlighting the need to make the human mind the strongest tool for problem-solving and to enhance its power through the use of thinking skills such as computational thinking (Barr & Stephenson, 2011). This encompasses a set of higher-order thinking skills that require the utilization of various data, techniques, and all available resources to solve problems (Bower & Falkner, 2015; Phillips, 2009).

Computational thinking fosters confidence along with the ability to persist in the face of complex problems and to handle open-ended issues, it allows for the practice of engagement and communication, enhancing critical thinking skills, and promoting innovation, exploration, and creativity across various disciplines. It stimulates the ability to communicate and collaborate with others, as well as the capacity to identify strengths and weaknesses in work to achieve a common goal or solve a specific problem (ISTE & CSTA, 2011; Yadav, 2017; Webb, 2013). The researcher notes that there are many types of thinking in mathematics, including basic thinking, scientific thinking, creative thinking, and critical thinking, each encompassing various skills. Mastering these skills enables students to engage effectively in those types of thinking. Numerous forms of thinking are mentioned, such as sensory or tangible thinking, abstract thinking, critical thinking, reflective thinking, creative thinking, insightful thinking, divergent thinking, convergent thinking, metacognitive thinking, and logical thinking. Computational thinking is considered a type of analytical thinking, sharing common methods with mathematical thinking that allow us to solve problems, and it collaborates with geometric thinking in the design and evaluation of real-world models (Wing, 2008). The researcher advocates for the flexible integration of computational thinking skills into mathematics curricula, while identifying the teaching skills that educators need to foster computational thinking skills among students, this integration is considered a crucial step in enhancing students' skills and developing their thinking comprehensively. By linking mathematics to concepts in computer science, students can acquire analytical skills and solve a variety of problems, which assist them in various aspects of their lives. This was supported by the study conducted by Bower et al. (2017), which aimed to clarify the mechanisms for the flexible integration of computational thinking skills into curricula and to identify the teaching skills necessary for teachers to develop these skills among students. Among the methods for training teachers in computational thinking teaching skills are those mentioned by Barr and Stephenson (2011) and Yadav et al. (2016), which provide professional development opportunities such as learning communities, summer institutes, and peer learning sessions facilitated by experienced teachers in computational thinking, and providing support in identifying the areas where computational thinking is integrated into teaching, and assisting teachers in recognizing current opportunities for integration while emphasizing the role of computational thinking in problem-solving, abstraction, iteration, and data analysis. Guiding teachers to effectively incorporate these concepts into their teaching practices and designing training programs to meet the needs of teachers, addressing specific training goals, and the challenges they face in their fields of expertise while enabling them to integrate computational thinking skills into their teaching. Including training programs to clarify the nature of the overlap between learning objectives in the subject area and computational thinking skills, thereby enabling teachers to incorporate those skills into their curricula, subsequently enhancing their students' learning outcomes and fostering a community of practice among teachers, thus encouraging collaboration and the sharing of experiences and knowledge with one another. It is suggested that professional development for computational thinking teaching skills should be continuous rather than occasional, to provide ongoing opportunities for learning and for developing their skills and knowledge over time.

As for the nature of financial culture, its definitions have varied, where Remund (2010) defines it as the degree to which an individual understands key financial concepts and possesses the ability and confidence to manage personal financial affairs by making appropriate decisions and engaging in sound financial planning while considering life events and changing economic circumstances. The Education and Training Evaluation Commission (2019) defines it as the ability to read, analyze, and manage personal financial circumstances that affect the quality of life and dignity, distinguish between financial options, competently discuss financial issues, plan for the future, and respond effectively to life events that impact daily financial decisions, including general economic events.

Financial culture seeks to achieve several goals, including fostering an understanding of financial culture to make it a part of every student’s life. It aims to clarify the nature of financial services offered by the financial sector to various segments of society. Financial culture contributes to increasing students' knowledge about diverse financial services and developing concepts, skills, values, and attitudes among students. It allows them to participate in the processes of choice and decision-making, encourages a focus on economics and saving, and teaches them to invest what they have wisely. Additionally, it aims to reduce wasteful consumption in all areas of life and prepare a generation that is familiar with accounting and marketing concepts, and how to create a personal and family budget. Furthermore, it helps to develop students' financial skills by providing information that enables them to make informed decisions regarding their financial transactions, thereby reducing the likelihood of exposure to risks in their professional lives, Pesando (2018) adds that financial culture contributes to preparing a generation that participates in achieving economic reform, endowing students with a leadership character capable of bearing responsibility, and equipping them with economic principles and management skills to allocate time and money effectively to achieve their goals, while being familiar with the necessary economic concepts in their real-life applications. The researcher notes that the implementation of financial education in school curricula is evident through the inclusion of financial culture in the study programs, allowing students to learn financial concepts and skills. Studies have supported that teaching financial culture has a positive impact on learners' behavior by integrating it into the educational curriculum, especially within the mathematics curriculum (OECD, 2015). This, in conjunction with the economic transformations and changes in the Kingdom of Saudi Arabia, necessitates providing students with the knowledge and skills required for future jobs, in line with what is stated in vision (2030) about learning to work and driving the economy. Among the skills required of teachers to teach financial culture in mathematics (Hassan, 2019) is possessing a degree of knowledge, skills, and values that qualify them to teach mathematics based on financial culture. This includes employing financial concepts and money management in educational situations, enabling students to manage their life finances and make sound financial decisions. Furthermore, it involves using financial and business technology tools, such as electronic financial and banking services, in educational contexts to demonstrate how to use them effectively and efficiently to meet financial needs and transactions, thereby guiding students' financial behavior. Additionally, it aims to shape students' financial behaviors by instilling positive financial practices through training on most sound financial practices and connecting financial concepts to real-life scenarios (such as saving, investing, and earning lawful income).

The researcher believes that suitable teaching strategies for teaching financial culture in mathematics lie in approaches and strategies that focus on student activity and are aligned with real-life applications, such as problem-solving strategies to address certain educational situations. Abstract concepts are linked to the actual reality of students during mathematics instruction. For example, when a real-life situation is presented to students about achieving balance in financial management, it prompts them to think about the existence of a problem. Students are then tasked with outlining procedural steps to solve it, employing brainstorming strategies to generate answers related to the question by recalling as many ideas and solutions as possible without discussing or critiquing them, focusing on quantity before quality, they then develop those ideas and solutions collectively. Additionally, discovery learning strategies whether guided or free discovery are utilized by directing students to work on individual or group research projects, enabling deep exploration of certain mathematical concepts and their connections to financial culture concepts, the use of role play is also emphasized, based on the assumption that the student has a role to perform, expressing themselves or representing someone else in a specific situation. This occurs in a safe environment with the cooperation of their peers, for example, where a student may take on the role of an investor in the school cafeteria.

Training programs receive significant attention at the level of educational institutions and are allocated material resources. Training encompasses three goals: knowledge, which includes a theoretical framework; examples of this include the objectives and functions of educational policies, laws, and regulations; skills, that pertain to work skills, communication skills, administrative tasks, and teaching skills. To illustrate the importance of training, Mahmoud and Hassan (2008), Al-Tartouri (2007), Aal Shweitar (2009), and Al-T'aani (2009) noted that it works to renew and update the information of qualified teachers and enhance it, in line with scientific advancements and rapid developments in curricula. It addresses the deficiencies in the preparation stage before entering the teaching profession, provides opportunities for renewal and innovation, and facilitates the exchange of ideas among teachers. It also fosters the development of educational theories and philosophies adopted by educational institutions, improves teacher performance and increases their efficiency, aiming for a high level of productivity at minimal costs. Furthermore, it prepares the school for educational accreditation by increasing teachers' attainment of standard levels of education quality, promoting professional growth for teachers to enhance their performance levels, increasing knowledge, developing skills, improving attitudes, and expanding the horizons of teachers in their profession field.

The researcher continues the discussion about the Caffarella model, as it is a competency-based design model used to develop training programs focused on achieving specific outcomes. Caffarella (2011) outlined its steps, which begin with distinguishing the context: this includes understanding the institution, the available resources, the individuals involved, what needs to be accomplished, good negotiation skills, and identifying strengths and trends. Building a strong support base includes obtaining support from learners, teachers, staff, community stakeholders, and decision-makers, as well as identifying the program ideas which encompass knowledge of the resources used to identify, generate, and evaluate these ideas. This involves developing a model for conducting appropriate evaluations for the situation, sorting program ideas, and prioritizing them by identifying priority ideas that are feasible, categorizing them into two groups: suitable for educational activities and those that require alternative interventions. Furthermore, develop program objectives, including the formulation of educational goals that reflect both measurable and non-measurable learning outcomes, utilizing both quantitative and qualitative methods, and comprehending alternative interventions. Designing educational plans involves creating clear and understandable educational objectives that align with the expected training outcomes, selecting and organizing content based on learning requirements, and employing techniques that support training outcomes and are appropriate for the trainees. Developing learning transfer plans involves understanding the participants in the program, the nature of the design, the content, the necessary changes to apply what has been trained, the organizational context, the community, and community forces, and utilizing the most beneficial technologies for the participants: coaching and training groups, support groups, feedback sessions, discussions, and formulating evaluation plans: by establishing assessment procedures, leveraging various opportunities to collect data, defining data collection methods, considering how to analyze the data, making recommendations, and presenting results through program review and adjustments, finalizing the design, and following up to clarify questions or challenges, in order to benefit similar programs. This also includes selecting formats and timelines, identifying teacher needs by determining who will implement the program inside or outside the institution, recognizing their needs and requirements, preparing budget and marketing plans by estimating the costs of development, design, and evaluation, determining funding, maintaining accurate budget records, estimating program returns, and coordinating between facilities and events: including identifying facilities and location, fostering a positive climate, implementing changes at the site, providing perks for program participants, as well as rewards and incentives. Previous studies on the subject of the study varied, where the study by Louis et al. (2024) aimed to design a training program for teachers to develop teaching skills in financial culture. The researchers utilized a descriptive approach by analyzing the content of

(28) research studies related to teacher training in financial culture. The study employed a content analysis tool and a narrative review method, leading to several findings, including that addressing budget, investment, savings, and banking services is important for the effectiveness of the training programs provided to teachers in the field of teaching financial culture. This includes planning, implementation, and evaluation, along with the use of different training methods to enhance effectiveness. The study by Compen et al. (2021) aimed to investigate the impact of teachers' attendance at training programs designed to develop teachers' financial culture teaching skills and thus improve their students' performance in this area. The researchers employed an experimental design using both experimental and control groups: one group of teachers participated in training programs to enhance their financial culture teaching skills, while the other group did not. The sample consisted of (1102) students from (30) schools. The study's results indicated an improvement in the teachers' financial culture teaching skills, which was reflected in the students' performance and their applications of financial culture, compared to students in the control group whose teachers did not attend the training programs.

The study by Mohammed and Khader (2023) aimed to identify the impact of the Caffarella Model on the academic achievement of fourth-grade female students in Sociology. The study sample consisted of two groups: an experimental group of (31) students and a control group of (33) students. The study employed an experimental research design and utilized an achievement test and a cognitive thinking scale as the study tools. The findings revealed that the female students in the experimental group, who studied according to the Caffarella Model, outperformed the female students in the control group.

The study by Al-Saad and Al-Zoghbi (2022) aimed to reveal the impact of a training program based on teaching practices according to the standards set by the National Council of Teachers of Mathematics (NCTM) on mathematics teachers' pedagogical knowledge and their beliefs about it. The study followed a quasi-experimental design, and the sample consisted of (20) teachers. A test on pedagogical knowledge and a questionnaire about beliefs towards it were utilized. The results indicated statistically significant differences between the mean scores in the post-application favoring the experimental group. The study recommended focusing on developing the teaching practices of mathematics teachers. In addition to Al-Shehri's (2022) **study**, which aimed to identify the effectiveness of a training program based on the STEM approach in developing creative teaching skills among high school mathematics teachers, the study employed a quasi-experimental design with both pre- and post-application in an experimental group. The study sample consisted of (33) female teachers, and an observation checklist was used to measure primary teaching skills. The results of the study demonstrated the effectiveness of the training program in enhancing creative teaching skills among teachers. The study recommended that educational supervisors guide teachers in applying creative teaching skills.

The study by Alshaalan (2022) aimed to determine the effectiveness of a training program in algebraic reasoning and meaning comprehension in enhancing the teaching practices of secondary school teachers and the performance of their students. The results of the study indicated significant differences between the mean ranks of the teachers' scores in favor of the experimental group.

The study by Compen et al. (2019) aimed to conduct a review of studies that addressed the effectiveness and impact of training programs for developing teachers' knowledge and skills in teaching financial literacy. The study employed a descriptive method through analyzing the studies, with a sample consisting of (46) studies conducted between (2000-2017). The reviewed studies included experimental, quasi-experimental, and correlational studies. The researchers utilized a tool for analyzing the studies, and one of the prominent findings of the review was that training programs are effective in enhancing teachers' skills in teaching financial literacy in the classroom. Additionally, these training programs contributed to increasing teachers' confidence in their knowledge and skills related to financial literacy and its instruction.

The study by Hassan (2019) recommended training teachers to teach financial culture units to ensure the development of their economic concepts and skills. It also advised using appropriate teaching strategies that help enhance students' financial culture concepts, as well as incorporating educational activities and mathematical problems into math content that connect various branches of mathematics with real-life applications related to financial culture. Additionally, a study by **Fesenko (2018)** aimed to propose a vocational training framework for math teachers in teaching financial culture to their high school students. The study concluded that it is important to train teachers in instructional methods, such as contextual learning, problem-based learning, and learning through real or simulated tasks. It highlighted the significance of linking math teaching with financial culture in relation to the expected future tasks of students, while also involving students in lesson development and selecting mathematical problems related to financial content. Furthermore, the study emphasized the necessity of increasing teachers' awareness and skills in teaching financial culture to students, along with using innovative and varied methods to train math teachers in developing and teaching financial culture skills.

The study by Dituri et al. (2019) aimed to investigate the effectiveness of a training program that combines financial culture with mathematics. An experimental method was employed, applying it to a purposive sample consisting of (40) students who graduated from three different secondary schools. A financial culture test was utilized, and the study found statistically significant differences between the pre-test and post-test average scores of the students in favor of the post-test. The study recommended integrating the teaching of financial culture with mathematics for students and exploring its effectiveness in improving the application of financial culture in the future. Additionally, it suggested incorporating applications of personal financial culture into mathematics instruction.

The study by Bower et al. (2017) aimed to clarify the mechanisms for flexibly integrating computational thinking skills into the curriculum and to identify the teaching skills required by teachers to foster computational thinking skills in students. The study found several important results, including the significance of raising teachers' awareness about computational thinking and its skills, along with the necessity for professional development through training programs in the field of computational thinking. The study recommended the importance of regular workshops on computational thinking and its skills, as well as encouraging teachers to apply these skills in their teaching while providing them with adequate support.

The study by Al-Qaisi (2015) aimed to identify the impact of training mathematics teachers on the use of a proposed model in effectively acquiring some teaching skills. The study found statistically significant differences at the level of ($\alpha \leq 0.05$) between the mean performance of mathematics teachers on the performance scale for effective teaching skills in favor of the experimental group. In commenting on previous studies, the researcher benefited from earlier research in preparing the theoretical framework, developing tools, designing the training program, determining the methodology, outlining the procedures, identifying appropriate statistical methods to answer the research questions, validating its hypotheses, and interpreting the results.

Study Problem: The problem of the study arises from the focus on developing educational outcomes and the Human Capital Development Program (2021-2025), which aims to concentrate on the development and enhancement of learner capabilities and preparing them for the labor market, relying on competencies and skills that allow individuals to realize their potential based on a foundation of essential skills. These skills include higher-order thinking skills such as creative and analytical thinking, computational thinking, problem-solving skills, and adaptability. This concern is emphasized by the results of reports issued by the Organization for Economic Cooperation and Development (OECD) highlighting the weaknesses of Saudi students' performance in the PISA test (2018) compared to other participating countries in the same assessment (OECD, 2019), where the test includes the measurement of problem-solving skills and thinking skills to make sound judgments in various situations, as well as practical applications of mathematics, including areas of financial culture. This was confirmed by studies (Adam, 2019; Salah, 2016; Kanaan, 2020; Al-Maliki, 2015; Stefaniak, 2017), which indicated students' weaknesses in several mathematical thinking skills and financial culture, along with the current teaching skills aimed at developing thinking skills, as revealed by the study (Al-Shehri, 2022; Al-Qahfa & Al-Qawas, 2020), and a study (Aljuwayid, 2018; Abu Zaid, 2021) indicated that one of the problems faced in teaching in light of computational thinking skills is the disparity in the levels of teaching skills among teachers. As the researcher is a university professor in teaching mathematics curricula, he believes that combining mathematics instruction with computational thinking skills helps students think, especially when dealing with real-world problems, and finding solutions through accurate predictive models that help describe the patterns and processes that shape scientific and engineering activities. Among the life areas related to thinking and connected to mathematics applications is financial culture, which means being familiar with basic financial concepts and the ability to apply these concepts to manage financial resources efficiently and effectively to achieve financial security. Therefore, there arose a need to develop teachers in the areas of teaching computational thinking skills and financial culture in mathematics; this includes training programs. Thus, the current study’s problem can be defined as examining the effectiveness of a proposed training program based on the Caffarella model in developing computational thinking and financial culture teaching skills among middle school mathematics teachers.

Study Questions: *The study aimed to answer the following questions:*

First question: *What is the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking teaching skills among middle school mathematics teachers?*

Second question: *What is the effectiveness of the proposed training program based on the Caffarella model in developing financial culture teaching skills among middle school mathematics teachers?*

Third question: *What is the correlation between the development of computational thinking teaching skills among middle school mathematics teachers and the development of financial culture teaching skills?*

Fourth question: Are there statistically significant differences in the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking and financial culture teaching skills among middle school mathematics teachers, based on the variables (gender, educational qualification, and years of experience)?

Study Hypotheses: The study seeks to verify the validity of the following hypotheses:

-There are no statistically significant differences at the significance level (0.05) between the average scores of computational thinking teaching skills for teachers in the pre-test and post-test applications.

- There are no statistically significant differences at the significance level (0.05) between the average scores of financial culture teaching skills for teachers in the pre-test and post-test applications.

- There is no statistically significant positive correlation at the significance level (0.05) between the development of computational thinking teaching skills and the development of financial culture teaching skills.

- There are no statistically significant differences at the significance level ($\alpha \leq 0.05$) for computational thinking teaching skills and financial culture teaching skills among middle school mathematics teachers in the post-test application of the observation checklist based on the variables of gender, educational qualification, and number of years of experience.

Study Objectives

-To investigate the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking teaching skills among middle school mathematics teachers.

- To investigate the effectiveness of the proposed training program based on the Caffarella model in developing financial culture teaching skills among middle school mathematics teachers.

- To explore the correlational relationship between the development of computational thinking teaching skills and the development of financial culture teaching skills among middle school mathematics teachers.

- To identify statistically significant differences in the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking and financial culture teaching skills among middle school mathematics teachers, according to variables such as gender, educational qualification, and years of experience.

Study Importance: *The importance of the study is highlighted through the following:*

Theoretical Importance

-Providing a theoretical framework to enrich the cognitive (theoretical) aspect for teachers involved in designing training programs in computational thinking skills and financial culture teaching skills.

The study derives its importance from demonstrating financial culture as one of the main objectives of teaching mathematics at educational stages, especially the middle stage.

Applied Importance

The study aims to develop skills in teaching computational thinking and financial culture through a training program based on the instructional design model (Caffarella), in accordance with the philosophy of modern mathematics curricula and their application standards.

Offering a comprehensive training package that can benefit trainers in the Ministry of Education and its affiliated training centers; in training mathematics teachers on skills for teaching computational thinking and financial culture.

Contributing to raising the awareness of mathematics teachers to employ all computational and financial skills that can be applied to solve complex mathematical problems.

Study Boundaries

Human, Spatial, and Temporal Boundaries: The current study was limited to mathematics teachers in public middle schools under the Ministry of Education during the second semester of the academic year (1446 AH) in Al-Qunfudhah governorate.

Substantive (Procedural) Boundaries: The current study focused on identifying the "Effectiveness of a Proposed Training Program Based on the Caffarella Model in Developing Computational Thinking Teaching Skills and Financial Culture among Middle School Mathematics Teachers." The study tools consisted of an observation checklist to measure the level of computational thinking teaching skills, which included (25) skills divided into six main skills: analysis, abstraction, algorithmic thinking, pattern recognition, evaluation, and generalization, as well as an observation checklist for financial culture teaching skills, which included (planning, implementation, evaluation). Their validity and stability were confirmed.

Terminological and Procedural Definitions

Training Program: Al-Shahrani and Al-Riyashi (2020) define it as a planned process involving a set of activities designed to support the educational process, improve teachers' performance, and enhance their professional development post-appointment, continuing throughout their service. The researcher defines it as the competencies, skills, and practices aimed at preparing and qualifying mathematics teachers in various professional, technical, and administrative aspects through discussion and dialogue sessions that elevate their ability to produce and achieve quality learning.

Caffarella Model: As defined by Kalban and Millman (2013), is a framework designed to facilitate the process of education and training, assisting teachers or trainers in organizing their lessons based on logical and scientific principles to achieve cognitive, skill-based, and emotional objectives, or to help the trainer meet their goals with learners. Shehata and Al-Najjar (2003) defined it as a model that relies on the diversity and variety of educational alternatives available to provide experiences for learners through the amount and quality of ideas presented, and the prioritization of their presentation based on several factors, including entry behavior, the nature of the content delivered, and the desired learning outcomes.

Computational Thinking Teaching Skills: Wing (2006) defines it as the mental processes involved in framing problems and solutions, including information processing followed by successful implementation, or the thinking processes concerned with articulating a problem and expressing its solution in a way that enables an individual to consider executing it effectively, similar to the approach of computer scientists. The researcher defines it procedurally as a cognitive activity utilized by teachers to express problems in a manner that allows for reaching solutions using computational steps and algorithms.

Financial Culture: Hassan (2019) defines it as the knowledge, skills, and attitudes related to the financial context that assist learners in effectively managing their personal financial resources and making effective decisions that positively impact the individual's financial security and the economic growth of the community.

Mathematics Teachers: They are the main pillar of the educational system and play a vital role in shaping students' minds and developing their arithmetic and logical skills. They are distinguished by their ability to simplify complex concepts and make them accessible to students, contributing to the establishment of a solid foundation for mathematical and analytical thinking.

Middle School: This is a transitional phase that begins after elementary school and precedes secondary school. Students in this stage are typically aged between (12-15) years. It is a challenging period for growth and change, during which students gain more control over their bodies and experience increased intelligence. Adolescents in this phase begin to form their values and orientations.

Method and Procedures: This chapter presents an overview of the study curriculum, its population, and its sample, along with the study tool, the design procedures, their validity and stability, the variables involved, and the applied procedures and statistical methods used.

Study Methodology: The researcher employed a descriptive survey method, along with an experimental design using a one-group study, with both pre- and post-application assessments.

Study Population: The study population consisted of all mathematics teachers for the middle stage in schools under the Education Administration in Al-Qunfudhah Governorate, totaling (844) teachers for the academic year (1446 AH/2025 AD).

Study Sample: The sample included (55) mathematics teachers from the middle stage in public education schools under the Education Administration in Al-Qunfudhah Governorate, selected using simple random method, and Table (1) shows the distribution of the number of sample members according to the study variables.

Table (1): Distribution of the Number of Sample Members According to Study Variables

Variable	***Variable Levels***	***Sample***	***Percentage (%)***
Gender	Male	25	45%
	Female	30	55%
Educational Qualification	Bachelor's Degree	42	76%
	Master's and PhD	13	24%
Experience	Less than 5 years	16	29%
	From 5 to 10 years	25	45%
	More than 10 years	14	25%
Total		55	100%

Study Tools: The study tools consisted of two lists of skills for teaching computational thinking and financial culture, and a training program based on the Caffarella model for enhancing the skills of teaching computational thinking and financial culture. The details are as follows:

First: The Lists of Skills for Teaching Computational Thinking and Financial Culture: To conduct the study, it was necessary to prepare two lists of skills for teaching computational thinking and financial culture through the following steps:

Defining the objective of constructing the lists: The purpose of constructing these lists was to identify the skills for teaching computational thinking and financial culture necessary for middle school mathematics teachers, which should be developed in them, and then to benefit from this in creating observation cards, and subsequently incorporating them into the training program based on the identified needs for training the teachers on these skills.

Identification of sources for constructing the two lists: Derived from theoretical literature related to teaching skills in computational thinking and financial culture, as well as previous research and studies addressing the teaching of computational thinking skills and financial culture skills. This includes the national framework of general education curriculum standards and the specialized framework for the field of mathematics learning issued by the Education and Training Evaluation Commission, along with the student textbook and teacher's guide for the financial culture course at the middle school level.

Construction of the two lists in their initial form: Computational thinking teaching skills and financial culture teaching skills were identified, then compiled into a preliminary list. This list was presented to specialists in curricula and teaching methods, as well as experts in the field of computer science for evaluation and to benefit from their feedback and opinions.

Face Validity: The two lists were presented in their initial version to a group of specialized evaluators in mathematics curricula and teaching methods to benefit from their opinions and observations regarding the appropriateness of these skills for their intended purpose, their level of importance, and the proposed modifications. Based on the evaluators' feedback, adjustments were made.

Second: A Proposed Training Program Based on the Caffarella Model for Developing Computational Thinking and Financial Culture Teaching Skills: The program is aimed at middle school mathematics teachers to enhance their skills in teaching computational thinking and financial culture. The program was constructed according to the following steps:

Program Building: It was designed and implemented based on the components and steps of the Caffarella model, as follows:

Recognizing the Context of the Training Program

Focusing on understanding the internal structure related to the planning process and its procedures.

Identifying the teachers involved in facilitating the program's planning process through education management and school principals. Program ideas and topics were determined by reviewing textbooks and the content, exercises, and activities they include, examining the standards of the mathematics field, the general framework of curricula, benefiting from the PISA framework, and identifying the training needs of teachers through a pre-application of an observation checklist.

Clearly writing the program objectives that address teacher training, the expected changes resulting from it, and the practical aspects of the program.

Determining the method of delivering the training program and the number of days allocated for its implementation.

Designing evaluation forms for the program (the package, the trainer, and the training environment).

Designing practical activities based on the training program for implementation by the study sample.

Ensuring the readiness of the training halls and the availability of equipment.

Designing the training aspects of the program, including setting clear educational objectives, selecting and sequencing content, and developing educational materials.

Clearly developing the objectives, specifying what the trainees should be able to know, do, or understand by the end of the program.

Identify and compile the program content and educational materials, including the creation of presentations, brochures, activities, videos, and supporting enrichment materials. Select appropriate educational technologies and assessment strategies that align with training objectives and the characteristics of the trainees.

Create a positive learning environment, welcoming contributions with a positive tone and fostering a conducive atmosphere for training and active participation.

Main and Sub-Headings of the Training Program: The training program consists of 5 main headings, each with a number of sub-headings, as follows***:***

Computational Thinking: (The relationship between thinking and mathematics - Thinking and achievement in mathematics - The concept of computational thinking - The historical development of computational thinking - Traits of computational thinking).

Computational Thinking Teaching Skills: (Analysis - Abstraction - Algorithmic thinking - Pattern recognition - Generalization - Evaluation).

Financial Culture: (The concept of financial culture - The relationship between financial culture and mathematics - Financial culture and the PISA framework).

Areas of Financial Culture Teaching: (Planning, Implementation, Evaluation).

Training Applications for Lessons Based on Teaching Skills for Computational Thinking and Financial Culture: (Lesson planning based on computational thinking skills, Lesson planning based on financial culture teaching skills).

The activities used in the training program include a mix of individual and group activities, dual dialogues, self-learning in groups and individually, workshops, and presentations. This variety considers the differing characteristics and experiences of the teachers.

The training methods utilized in the program include dialogue and discussion, brainstorming, problem-solving, micro-teaching, cooperative learning, games, self-directed learning, summarization, practical application, and self-learning.

The training tools and techniques for the program include the use of presentations, videos, websites, and smartphone applications. The most notable programs, applications, and websites used in implementing training activities are Microsoft Teams, PowerPoint, Padlet, Sudoku puzzles, Magic Cube, Google Forms, Miro, Canva, Google Drive, and YouTube.

Study Tools

First: Observation Card to Measure the Level of Computational Thinking Teaching Skills among Middle School Mathematics Teachers: The current study relied on an observation card to determine the performance level of middle school mathematics teachers in teaching computational thinking skills. The card was chosen as a tool to achieve the study's objectives because it is capable of assessing the level of teaching skills. The card was designed according to the following steps:

Define the objective of the observation card: The card aims to assess the level of computational thinking teaching skills, thereby identifying the training needs of teachers in those skills to evaluate the effectiveness of the training program.

Formulate the items of the observation card: Items were formulated based on a list of teaching skills necessary for mathematics teachers in light of computational thinking skills, in addition to several educational literatures related to teaching skills for teachers and computational thinking skills.

Prepare the initial version of the observation card: This involved creating specific and clear procedural statements for the required teaching skills, after dividing them into core skills and their sub-skills, such that each statement describes the skill intended to be observed and measured; following modifications to the list of validated and detailed computational thinking skills in the study materials.

Formulate instructions for the observation card: The instructions page of the observation card included two main sections:

First: Preliminary data, which includes (teacher's name, school name, grade, lesson title, day, date).

Second: Instructions for using the observation card, explaining the purpose of the observation card and the number of teaching skills for teachers, as well as the areas they are distributed across.

Verification of the Validity of the Observation Card Phrases: The validity of the observation card phrases was verified using two methods:

A.Face Validity (Arbitrators Validity): Face validity was assessed by presenting the content of the card to a group of specialized arbitrators in the fields of curriculum, teaching methods, and computer science to ensure clarity of phrases, their relevance to the core skill, linguistic correctness, and consideration of the card's structure and appropriateness, along with their feedback. After making all suggested modifications, the researcher arrived at the final version of the observation card for computational thinking teaching skills, which included (25) skills divided into six main categories: analysis, abstraction, algorithmic thinking, pattern recognition, evaluation, and generalization.

B.Internal Consistency Validity: The internal consistency validity of the card phrases was verified by calculating the Pearson correlation coefficient between each phrase of the card and the total scores of the main skill to which the phrase belongs.

First: Results of Internal Validity (Construct Validity): To assess the construct validity of the observation card for developing computational thinking teaching skills, the tool was applied to an exploratory sample of (20) teachers outside the study sample. The corrected Pearson correlation coefficient for each item with the dimension to which the item belongs was calculated. A statistical significance criterion was adopted for the correlation of each item with the dimension and the tool as a whole to retain the item in the tool, as shown in the following table:

Table (2): Correlation Coefficients Between the Scores of Each Phrase on the Observation Card and the Total Score of Computational Thinking Teaching Skills

Analysis		***Abstraction***		***Pattern Recognition***		***Algorithmic Thinking***		***Evaluation***		***Generalization***	
m	Correlation Coefficient	m	Correlation Coefficient	m	Correlation Coefficient	m	Correlation Coefficient	m	Correlation Coefficient	m	Correlation Coefficient
1	.848**	6	.756**	10	.924**	13	.899**	18	.732**	23	.712**
2	.570**	7	.665**	11	.768**	14	.925**	19	.878**	24	.820**
3	.583**	8	.729**	12	.636**	15	.882**	20	.843**	25	.814**
4	.599*	9	.753**			16	.704**	21	.979**		
5	.861**					17	.598**	22	.945**		

***** Statistically significant at the significance level (0.01)***

**** Statistically significant at the significance level (0.05)***

The results shown in Table (2) indicate that the correlation coefficients between the items of each dimension and the total score of the dimension are statistically significant at the significance level of (0.01), which suggests that the tool has high validity, allowing for its application in the study. Additionally, the validity of the dimensions of the card tool with the total score of the card has been confirmed, as seen in the following Table (3):

Table (3): Correlation Coefficients of Computational Thinking Teaching Skills with the Total Score of the Observation Card

Dimensions	***Analysis***	***Abstraction***	***Pattern Recognition***	***Algorithmic Thinking***	***Evaluation***	***Generalization***	***Total Score***
Analysis	-	1	.684**	.792**	.707**	.654**	.769**
Abstraction	-	-	1	.726**	.743**	.550**	.763**
Pattern Recognition	-	-	-	1	.820**	.638**	.803**
Algorithmic Thinking	-	-	-	-	1	.620**	.800**
Evaluation	-	-	-	-	-	1	.806**

Generalization	-	-	-	-	-	-	1

***** Statistically significant at the significance level (0.01)***

The results presented in Table (3) indicate that the correlation coefficients for the dimensions of developing computational thinking teaching skills with the total score of the dimensions are statistically significant at the significance level (0.01), with correlation coefficients ranging between (0.763 - 0.806). The highest correlation coefficient was for the evaluation dimension (0.806), indicating that the research tool has high validity, allowing its application to the sample members of the study.

Stability of the Observation Card: The stability of the observation card was verified using the inter-observer agreement method. The researcher, in collaboration with another researcher in the same field, applied it to an exploratory sample of (10) middle school mathematics teachers from schools outside the study sample. The stability coefficient between the two observations was then calculated using Cooper's formula as follows:

Stability coefficient = (Number of agreements / Number of agreements + Number of disagreements) × 100

Table (4): Results of the Stability Calculation of the Observation Card for Developing Computational Thinking Teaching Skills

Dimension	*Number of Agreements*	*Number of Disagreements*	*Stability Coefficient*
Analysis	95	15	86%
Abstraction	88	12	88%
Pattern Recognition	43	9	83%
Algorithmic Thinking	120	12	91%
Evaluation	105	13	89%
Generalization	55	8	87%
Overall	506	69	88%

The stability coefficient reached (0.88), which indicates a high stability index for the observation card that can be relied upon in the final application of the card. After verifying the validity and stability, the observation card was developed in its final form.

Application of the Observation Card: After ensuring the validity and stability of the research tool, the researcher began to apply the observation card in the second semester of the academic year (1446 AH) on a sample consisting of (55) male and female teachers.

Quantitative Assessment of Skill Availability in the Observation Card: The observation card was coded such that the availability of skill is rated as (High) with a score of (3), (Medium) with a score of (2), and (Low) with a score of (1). The assessment of the arithmetic average value was determined as follows:

Table (5): Criterion for Judging the Average Level of Performance

M	*Skill Performance Level*	*Score*	*Average Performance Level (Arithmetic Average)*
1	Low	1	From 1 to less than 2.34

2	Medium	2	From 2.34 to less than 3.67
3	High	3	From 3.67 to less than 5.00

Second: Observation Card for Financial Culture Teaching Skills of Middle School Mathematics Teachers: The card was adopted as a tool to collect the required data from a sample of teachers to determine their level of practice in teaching financial culture skills. The objective of the card was defined, and the items of the card were formulated, along with the preparation of the preliminary version of the card. The method for assessing performance was established, and the level of availability of the corresponding teaching skill was determined. The assessment of teachers' performance was set according to a graduated scale consisting of three verbal ratings indicating the level of availability of these skills among the teachers: (High, Medium, Low). The validity of the phrases on the observation card was verified through two methods, which are:

Face Validity (Arbitrators Validity): The face validity was represented by presenting the content of the card to a group of specialized arbitrators in the fields of curriculum and teaching methods, as well as computer science, to ensure the clarity of the phrases, their affiliation with the core skill, the correctness of the linguistic formulation, and to examine the sequence of the card and its appropriateness. The arbitrators provided their opinions, and the observation card received significant approval from the arbitrators regarding its axes and phrases. The arbitrators' comments were revised, and the card contained three main skills: planning, implementation, and evaluation.

Internal Consistency Validity: To verify the internal construct validity of the observation card using Pearson correlation coefficient, the tool was applied to an exploratory sample of (20) teachers outside of the study sample. The corrected Pearson correlation coefficient was calculated for the correlation of each item with the dimension to which it belongs. A criterion for statistical significance was adopted to determine the correlation of the item with the axis and the tool as a whole, in order to retain the item in the tool, as shown in the following table:

Table (6): Correlation Coefficients of Sub-Skill with the Main Skill Followed for the Development of Financial Culture Teaching Skills

Planning		***Implementation***				***Evaluation***			
Paragraph Number	Correlation Coefficient	Paragraph Number	Correlation Coefficient	Paragraph Number	Correlation Coefficient	Paragraph Number	Correlation Coefficient	Paragraph Number	Correlation Coefficient
1	.599**	6	.691**	11	.502*	16	.736**	21	.519*
2	.731**	7	.544**	12	.849**	17	.723**		
3	.753**	8	.805**	13	.680**	18	.711**		
4	.813**	9	.653**	14	.649**	19	.780**		
5	.572**	10	.739**	15	.508*	20	.537*		

***** Statistically significant at the significance level (0.01)***

**** Statistically significant at the significance level (0.05)***

The results presented in Table (6) indicate that the correlation coefficients between the items of each dimension and the overall score of the dimension are statistically significant at the significance level of (0.01) and some at the significance level of (0.05), which suggests that the card possesses high validity and allows for its application in the study. Additionally, the validity of the dimensions of the card tool with the total score of the card was verified as shown in the following Table (7):

Table (7): Correlation Coefficients of the Dimensions of Financial Culture Skills Development with the Total Score of the Observation Card

Dimensions	***Planning***	***Implementation***	***Evaluation***	***Total Score***
Planning	1	.691**	.735**	.837**
Implementation	-	1	.804**	.954**
Evaluation	-	-	1	.920**

***** Statistically significant at the significance level (0.01)***

**** Statistically significant at the significance level (0.05)***

The results presented in Table (7) indicate that the correlation coefficients of the key skills for developing financial culture teaching skills with the overall skill score are statistically significant at the significance level of (0.01), with correlation coefficients for the dimensions ranging between (0.837-0.954). The highest correlation coefficient was for the implementation dimension (0.954). This result suggests that the study tool has a high validity, allowing it to be applied to the study sample members.

Stability of the observation card: The stability of the observation card was verified using the observer agreement method. The researcher, in collaboration with another researcher in the field of mathematics, applied it to an exploratory sample of mathematics teachers in the middle school, consisting of (10) teachers who were not part of the study sample. The coefficient of stability between the two observations was calculated using the following Cooper equation:

Stability coefficient = (Number of agreements / Number of agreements + Number of disagreements) × 100

Table (8): Results of Calculating Stability of the Observation Card for Financial Culture Teaching Skills

Dimensions	***Number of Agreements***	***Number of Disagreements***	***Stability Coefficient***
Planning	112	12	90%
Implementation	256	35	88%
Evaluation	130	23	85%
Overall	498	70	88%

The stability coefficient reached (87.66), which indicates a high stability coefficient for the observation card that can be relied upon in the final application of the card.

Statistical methods used in the study: The statistical methods used in the study are as follows: the use of arithmetic averages and standard deviations, and Pearson correlation coefficient to ensure the internal consistency validity of the two observation cards, and the Cooper equation to assess inter-rater agreement to confirm the reliability of the observation card. Additionally, a paired sample "t" test was used to determine the statistical differences between the pre-implementation and post-implementation of the observation cards for teaching computational thinking skills and financial culture skills. The Cohen's (d) equation was used to calculate effect size to determine the effectiveness of the independent variable, which is the training program, on the two dependent variables: computational thinking teaching skills and financial culture teaching skills.

Study Results and Discussion: The results related to the first question, which states: **"What is the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking teaching skills among middle school mathematics teachers?"** To answer this question, the first hypothesis was tested, which states: **"There are no statistically significant differences at the significance level (0.05) between the mean scores of computational thinking teaching skills of teachers in the pre-application and post-application",** where the researcher applied a pre-observation card to middle school mathematics teachers by attending a regular lesson for each teacher, observing their performance, and recording it in light of the performance level options corresponding to each sub-skill: (high, medium, low). Following this, they received training on the training program. The observation card was then reapplied to the teachers, considering the opportunity to observe the teachers in another lesson, whether through pre-application or post-application of the observation card, in cases where the lesson showed a weak connection to computational thinking skills. After collecting all the data, differences were tested between the mean performance scores of the teachers before and after the application of the proposed training program for the observation card of computational thinking teaching skills for the six main skills: (analysis, abstraction, pattern recognition, algorithmic thinking, evaluation, and generalization) and the related sub-skills. To verify the validity of the hypothesis, the arithmetic averages and standard deviations were calculated, as well as the "t" test for related samples, as shown in Table (9).

Table (9): The Arithmetic Averages, Standard Deviations, and (T) Value for the Two Correlated Groups for the Pre- and Post-Application of the Observation Card for Computational Thinking Teaching Skills

Dimensions	***Test***	***Number***	***Degrees of Freedom***	***Arithmetic Average***	***Standard Deviation***	***T-Value***	***Significance Value***	***Significance Level***
Analysis	Pre-test	55	54	2.06	.86	9.981	.000	0.05
	Post-test	55		3.47	.61			
Abstraction	Pre-test	55	54	2.31	.85	6.645	.000	0.05
	Post-test	55		3.44	.79			
Pattern Recognition	Pre-test	55	54	1.88	1.10	8.574	.000	0.05
	Post-test	55		3.46	.83			

Algorithmic Thinking	Pre-test	55	54	2.16	1.04	8.926	.000	0.05
	Post-test	55		3.73	.66			
Evaluation	Pre-test	55	54	1.80	.99	10.030	.000	0.05
	Post-test	55		3.60	.78			
Generalization	Pre-test	55	54	1.88	.90	11.453	.000	0.05
	Post-test	55		3.85	.73			
Overall	Pre-test	55	54	2.03	.78	10.945	.000	0.05
	Post-test	55		3.59	.61			

The results in Table (9) indicate that the t-test values for the significance of the differences between the pre-test and post-test averages of teaching skills for teachers were as follows: (9.981), (6.645), (8.574), (8.926), (10.030), (11.453), and the total score was (10.945). All these values were statistically significant, indicating that there are statistically significant differences at the significance level ($\alpha \leq 0.05$) between the average scores of the pre-test and the average scores of the post-test for the observation card. The differences favored the post-test in the six main teaching skills related to computational thinking skills: (analysis, abstraction, pattern recognition, algorithmic thinking, evaluation, generalization) and the total score for the skills. Thus, the alternative hypothesis is accepted, which states that "There are statistically significant differences at the significance level (0.05) between the average scores of the pre-test and the average scores of the post-test" for the total score of the card; following the proposed training based on the Caffarella model in developing computational thinking teaching skills among middle school mathematics teachers, and the null hypothesis, which states "There are no statistically significant differences at the (0.05) significance level between the mean scores of the pre-application and the mean scores of the post-application of the observation card and the total score of the card," was rejected. This indicates an improvement in the teachers' skills in teaching computational thinking at both the core skills and sub-skills levels, as evidenced by the differences between the pre- and post-application in favor of the post-application. To verify the effectiveness of the training program in developing computational thinking teaching skills for mathematics teachers, Cohen's d equation was calculated for the six core skills and for the skills as a whole using the equation (Goulet-Pelletier & Cousineau, 2018):

$$d = \frac{Means\ Differences}{Standard\ Deviation} = \frac{\mu 1 - \mu 2}{psd}$$

Table (10): Results of Cohen's Equation for Detecting the Effect Size of the Training Program for Computational Thinking Teaching Skills

Skill	*Application*	*Arithmetic Average*	*Mean Differences*	*Standard Deviation*	*d Value*	*Effect / Size*
Analysis	Post-test	3.47	1.41	0.75	1.89	Large
	Pre-test	2.06				
Abstraction	Post-test	3.44	1.13	0.82	1.38	Large
	Pre-test	2.31				
Pattern Recognition	Post-test	3.46	1.58	0.97	1.62	Large
	Pre-test	1.88				
Algorithmic Thinking	Post-test	3.73	1.57	0.87	1.80	Large
	Pre-test	2.16				
Evaluation	Post-test	3.60	1.8	0.89	2.02	Large
	Pre-test	1.80				
Generalization	Post-test	3.85	1.97	0.82	2.40	Large
	Pre-test	1.88				
Overall Score	Post-test	3.59	1.56	0.70	2.23	Large
	Pre-test	2.03				

It is evident from Table (10) that the values of (d) were (1.89), (1.38), (1.62), (1.80), (2.02), and (2.40), which indicate a large effect size of the training program on the skills: (analysis, abstraction, pattern recognition, algorithmic thinking, generalization, and evaluation). The Cohen's coefficient value was (2.23), which is greater than (0.8). Cohen (1988) stated that the levels of effect size are as follows:

Effect Size Levels	*Small*	*Medium*	*Large*
D Value	0.2	0.5	0.8

The results indicate the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking teaching skills among mathematics teachers.

The results related to answering the second question, which states: "What is the effectiveness of the proposed training program based on the Caffarella model in developing financial culture teaching skills among middle school mathematics teachers?" were addressed through testing the second hypothesis of the study, which stated: "There are no statistically significant differences at the significance level (0.05) between the mean scores of financial culture teaching skills for teachers in the pre-test and post-test applications", where the researcher initially applied an observation card to middle school mathematics teachers by attending a regular class for each teacher in middle school, observing their performance, and recording it in light of the performance level options corresponding to each sub-skill: (high, medium, low). Then, the teachers were trained on the training program. After that, the observation card was reapplied to the teachers, taking into account the opportunity for the teacher to observe another class, whether through a pre-application or a post-application of the observation card; in case the lesson showed a weak correlation with financial culture teaching skills. Once all the data were collected, the differences between the mean performance scores of the teachers before and after applying the proposed training program were tested for the financial culture teaching skills observation card; for the three teaching skills, which are: (planning, implementation, and evaluation) and their corresponding sub-skills. To verify the hypothesis, the arithmetic averages and standard deviations were calculated, as well as the (T) test for related samples, as shown in Table (11).

Table (11): The Arithmetic Averages, Standard Deviations, and (T) Value for the Two Correlated Groups in the Pre- and Post-Application of the Observation Card for the Training Program in Developing Financial Culture Teaching Skills among Middle School Mathematics Teachers

Dimensions	***Observation***	***Number***	***Degrees of Freedom***	***Arithmetic Average***	***Standard Deviation***	***T-Value***	***Significance Value***	***Significance Level***
Planning	Pre-test	55	54	1.64	.67	25.246	0.000	0.05
	Post-test	55		4.30	.47			
Implementation	Pre-test	55	54	2.02	.84	11.483	0.000	0.05
	Post-test	55		3.55	.49			
Evaluation	Pre-test	55	54	1.83	.93	12.973	0.004	0.05
	Post-test	55		3.52	.44			
Overall	Pre-test	55	54	1.88	.74	16.672	0.000	0.05
	Post-test	55		3.72	.37			

Statistically significant at the significance level (0.05)

The results in Table (11) indicate that the "t" test values for the significance of the differences between the means of the pre-test and post-test scores for teaching skills among teachers were (25.246), (11.483), (12.973), and for the overall score (16.672). All of these values were statistically significant, which means there are statistically significant differences at the significance level ($\alpha \leq 0.05$) between the mean pre-test scores and the mean post-test scores of the observation card. The differences favored the post-test application of the three main teaching skills related to financial culture skills: (planning, implementation, evaluation). Thus, the alternative hypothesis is accepted, which states, "There are statistically significant differences at the significance level (0.05) between the mean pre-test scores and the mean post-test scores for the total score of the card and for each dimension of it, after the application of the proposed training program based on the Caffarella model to develop financial culture teaching skills among middle school mathematics teachers." The null hypothesis, stating "There are no statistically significant differences at the significance level (0.05) between the mean pre-test scores and the mean post-test scores of the observation card and for the total score of the card," has been rejected. To verify the effectiveness of the training program in developing financial culture teaching skills for mathematics teachers, Cohen's (d) equation was calculated for the three main skills and for the skills as a whole in the following table:

Table (12): Results of Cohen's Equation for Detecting the Effect Size of the Training Program for Financial Culture Teaching Skills

Skill	***Observation***	***Arithmetic Average***	***Mean Differences***	***Standard Deviation***	***d Value***	***Effect / Size***
Planning	Post-test	4.30	2.66	0.58	4.60	Large
	Pre-test	1.64				
Implementation	Post-test	3.55	1.53	0.69	2.22	Large
	Pre-test	2.02				
Evaluation	Post-test	3.52	1.69	0.73	2.32	Large
	Pre-test	1.83				
Overall Score	Post-test	3.72	1.84	0.59	3.15	Large
	Pre-test	1.88				

Cohen (1988) stated that the levels of effect size are as follows:

Effect Size Levels	***Small***	***Medium***	***Large***
D Value	0.2	0.5	0.8

As shown in Table (12), the values of Cohen's coefficient were (4.60), (2.22), and (2.32), indicating a significant effectiveness of the training program in the skills of planning, implementation, and evaluation, with an overall score of (3.15) for all skills as a whole, which signifies great effectiveness. Therefore, the results indicate the effectiveness of the proposed training program based on the Caffarella model in enhancing financial culture teaching skills among middle school mathematics teachers. The researcher attributes this result to the integration of mathematical concepts and financial culture in a purposeful manner, providing mathematics activities grounded in the needs and interests of the students more effectively. This is supported by a positive correlation found in PISA tests between financial culture and mathematics, achieving integration between mathematics curricula and real-life applications. This aligns with the study by Kang and Kang (2007), which indicated that teaching financial culture to students through the curriculum by continuously developing related teaching programs and offering training programs for teachers enhances financial culture teaching skills.

Furthermore, the content of the training program provided real-world mathematical applications for computational thinking, along with diverse training methods. Prior to the training process, there was a deficiency in cognitive and applied aspects of computational thinking skills, which generated a serious desire among them to acquire knowledge and skills related to computational thinking, thus developing their teaching skills.

The results related to answering the third question, which states: "Is there a correlational relationship between computational thinking teaching skills and financial culture teaching skills among middle school mathematics teachers?" To answer this question and to identify the correlational relationship between computational thinking skills and financial culture teaching skills, the hypothesis was tested, which stated: "There is no statistically significant correlational relationship at the significance level ($\alpha \geq 0.05$) between computational thinking teaching skills and financial culture teaching skills among middle school mathematics teachers." By calculating the Pearson correlation coefficient between computational thinking teaching skills and financial culture teaching skills, the results were as follows:

Table (13): Pearson Correlation Coefficients for the Relationship Between Computer Teaching Skills Development and Financial Culture Skills Development

Financial Culture Teaching Skills / ***Computational Thinking Teaching Skills***	***Planning***	***Implementation***	***Evaluation***	***Overall Score***
Analysis	.571**	.129	.549**	.596**
Abstraction	.737**	.373**	.644**	.675**
Pattern Recognition	.746**	.331*	.682**	.670**
Algorithmic Thinking	.728**	.271*	.736**	.564**
Evaluation	.800**	.387**	.734**	.679**
Generalization	.684**	.406**	.641**	.465**
Overall	.854**	.375**	.798**	.735**

***** Statistically significant at the significance level (0.01)***

**** Statistically significant at the significance level (0.05)***

Table (13) shows a positive and statistically significant correlation between the dimensions of computational thinking teaching skills and financial culture teaching skills in general, with a correlation value of (0.735). Therefore, the null hypothesis, which states that "there is no statistically significant correlation at the significance level ($\alpha \geq 0.05$) between computational thinking teaching skills and financial culture teaching skills among mathematics teachers in the middle school stage in the post-application of the observation card," is rejected. The alternative hypothesis, which states that "there is a statistically significant correlation at the significance level ($\alpha \geq 0.05$) between computational thinking teaching skills and financial culture teaching skills among mathematics teachers in the middle school stage in the post-application of the observation card," is accepted. The researcher interprets this result as aligning with the guidelines of Vision (2030), which emphasizes the importance of promoting financial culture among students in schools. They need a minimum level of financial culture to help them manage their financial matters, such as consumption and saving. Therefore, the focus on teaching financial culture to students has become a national demand, noting the scarcity of educational programs targeting this demographic at this stage; its role in their financial education, and its impact on shaping the learner's character and guiding their future experiences, is critical. This is one of the essential requirements for the sustainable human development of individuals, which was highlighted by the National Conference on Financial Culture for Educators held at the JumpStart Coalition in November (2009); it called for attention to practices that support financial cultures through educational curricula. This has reflected on the content of the training program for teaching computational thinking skills and financial culture skills, as well as establishing applied workshops for lessons to combine these skills within a single lesson focusing on planning, implementation, and evaluation. It encourages discussion of observations among the trainees and the continuation of communication with them post-training for classroom application. This is supported by the study by Akcay et al. (2022), which demonstrated that the availability of thinking skills as new competencies among teachers and training mathematics teachers are requirements for improving learning outcomes and achieving the development of teaching skills among teachers in accordance with evolving needs at both the national and global levels. This underscores the necessity of training teachers in computational thinking skills, as shown in the study by Yadav et al. (2017), which aimed to identify the role of training programs for teachers in developing computational thinking skills and teaching these skills.

The results related to answering the fourth question, which states: "Are there statistically significant differences in the effectiveness of the proposed training program based on the Caffarella model in developing computational thinking and financial culture teaching skills among middle school mathematics teachers, based on the variables (gender, educational qualification, and years of experience)?" This question was answered according to each variable as follows:

First: Computational thinking teaching skills: To answer this question, the arithmetic averages and standard deviations were extracted for the effectiveness of the proposed training program based on the Caffarella model in developing the skills of teaching computational thinking among middle school mathematics teachers in the post-application of the observation card based to the variables (gender, educational qualification, and years of experience); the following table illustrates these results

Table (14): Arithmetic Averages and Standard Deviations for the Post-Measurement of the Observation Card for Computational Thinking Teaching Skills According to Gender, Educational Qualification, and Years of Experience

Variable	*Variable Levels*	*Number*	*Arithmetic Average*	*Standard Deviation*
Gender	Male	25	3.27	0.73
	Female	30	3.85	0.28
Educational Qualification	Bachelor's	42	3.65	0.45
	Master's and PhD	13	3.41	0.96
Years of Experience	Less than 5 years	16	3.68	0.69
	5 to 10 years	25	3.59	0.40
	More than 10 years	14	3.49	0.81

Table (14) shows the apparent differences in the arithmetic averages and standard deviations of the effectiveness of a proposed training program based on the Caffarella model in developing computational thinking teaching skills among middle school mathematics teachers in the post-application of the observation card according to the variables of gender, educational qualification, and years of experience. To determine the significance of the differences, a three-way analysis of variance was conducted, and the following table presents these results:

Table (15): Three-Way Analysis of Variance for Post-Measurement of the Observation Card for Computational Thinking Teaching Skills According to the Variables of Gender, Educational Qualification, and Years of Experience

Source	*Sum of Squares*	*Degrees of Freedom*	*Mean Squares*	*F-Value*	*Statistical Significance*
Gender	4.823	1	4.823	17.107	.000*
Educational Qualification	.237	1	.237	.842	.363
Years of Experience	.727	2	.364	1.290	.284

Error	14.097	50	.282		
Overall	19.787	54			

**** Statistically significant at the significance level (0.05)***

Table (15) shows significant statistical differences in computational thinking teaching skills among middle school mathematics teachers in the post-application of the observation card based on the gender variable, where its "F" value reached (17.107). Therefore, the null hypothesis, which states that "there are no significant statistical differences at the significance level ($\alpha \leq 0.05$) in computational thinking teaching skills among middle school mathematics teachers in the post-application of the observation card based on the gender variable," is rejected. The alternative hypothesis, which states "there are significant statistical differences at the significance level ($\alpha \leq 0.05$) in computational thinking teaching skills among middle school mathematics teachers in the post-application of the observation card based on the gender variable and in favor of females," is accepted. It is evident from Table (15) that there are no statistically significant differences in the skills of teaching computer thinking among mathematics teachers in the middle stage in the post-application of the observation card based on the variables of scientific qualification and years of experience, as the value of "F" reached (0.842) and (1.290), respectively. Thus, the null hypothesis is accepted, which states that "there are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the skills of teaching computational thinking among middle school mathematics teachers in the post-application of the observation card based on the variables of educational qualification and years of experience." The researcher interprets this result to mean that all sample members lack prior experience with the content of the training program and have no previous experience with the steps of this program. Everyone relied on their previous teaching experiences before joining the training program to employ computer thinking skills, teaching methods, and integrate them into classroom educational activities, and it requires providing an engaging and stimulating environment to enhance active learning of computational thinking skills, along with the selection of appropriate teaching methods such as discussion, inquiry, and project-based training. The teacher is responsible for designing activities to learn computational thinking skills and to present challenges to the student without causing frustration but rather encouraging them to persist. This allows the student to grasp the concept of computational thinking and the skills that comprise it. The teacher also selects suitable assessment methods to include practical, kinetic, and emotional performance before, during, and after the educational situation; thus, achieving educational goals effectively and efficiently. Furthermore, it is important to clarify the nature of the interplay between learning objectives and computational thinking skills, enabling students to integrate these skills into their curricula, ultimately enhancing their learning outcomes. This aligns with the results of the study by Bower et al. (2017).

Second: Financial Culture Teaching Skills: To answer this question, the arithmetic averages and standard deviations were extracted for the effectiveness of a proposed training program based on the Caffarella model in developing financial culture teaching skills among middle school mathematics teachers, in the post-application of the observation card according to the variables of gender, educational qualification, and years of experience. The following table presents these results:

Table (16): Arithmetic Averages and Standard Deviations for the Post-Measurement of the Observation Card for Financial Culture Teaching Skills According to the Variables of Gender, Educational Qualification, and Years of Experience

Variable	*Variable Levels*	*Number*	*Arithmetic Average*	*Standard Deviation*
Gender	Male	25	3.56	0.43
	Female	30	3.86	0.25
Educational Qualification	Bachelor's	42	3.72	0.32
	Master's and PhD	13	3.73	0.51
Number of Years of Experience	Less than 5 years	16	3.67	0.37
	5 to 10 years	25	3.72	0.29
	More than 10 years	14	3.78	0.50

Table (16) shows the existence of apparent differences in the arithmetic averages and standard deviations for the effectiveness of the proposed training program based on the Caffarella model in developing financial culture teaching skills among middle school mathematics teachers in the post-application of the observation card according to the variables of gender, educational qualification, and number of years of experience. To determine the significance of the differences, a three-way analysis of variance was conducted, and the following table presents these results:

Table (17): Three-Way Analysis of Variance for the Post-Measurement of the Observation Card for Financial Culture Teaching Skills Based on the Variables of Gender, Educational Qualification, and Years of Experience

Source	*Sum of Squares*	*Degrees of Freedom*	*Mean Squares*	*F-Value*	*Statistical Significance*
Gender	1.202	1	1.202	9.847	.003*
Educational Qualification	.027	1	.027	.223	.638
Years of Experience	.097	2	.049	.399	.673
Error	6.105	50	.122		
Total	7.408	54			

**** Statistically significant at the significance level (0.05)***

Table (17) shows statistically significant differences in the financial culture teaching skills of middle school mathematics teachers in the post-application of the observation card, based on the gender variable, where the value of "F" was (9.847). Thus, the null hypothesis, which states that "there are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the financial culture teaching skills of middle school mathematics teachers in the post-application of the observation card based on the gender variable," is rejected. Conversely, the alternative hypothesis is accepted, which states that "there are statistically significant differences at the significance level ($\alpha \leq 0.05$) in the financial culture teaching skills of middle school mathematics teachers in the post-application of the observation card based on the gender variable, and in favor of females." Table (17) shows that there are no statistically significant differences in the skills of teaching financial culture among middle school mathematics teachers in the post-application of the observation card, based on the variable of educational qualification and years of experience, where the "F" value was (0.223) and (0.399), respectively. Thus, the null hypothesis is accepted, which states that "there are no statistically significant differences at the significance level ($\alpha \leq 0.05$) in the skills of teaching financial culture among middle school mathematics teachers in the post-application of the observation card, based on the variable of educational qualification and years of experience." The researcher interprets this result by noting that all members of the sample who joined the training lacked prior experience regarding the content of the training program. They relied on their previous experiences in teaching financial literacy skills before joining the training program. This positively reflects their ability to apply these skills during classroom situations and their response to keeping up with future economic developments. The goal is to cultivate students who are economically literate and prepared for the job market, providing equal opportunities for all students to succeed in their professional and personal lives, while enhancing the quality and level of education. This includes reinforcing positive behaviors alongside the essential knowledge required for employment, disseminating this culture among students in schools, and managing their financial matters such as consumption and savings. The aim is to equip students with the information and knowledge that will help them understand financial products and risks, and to prepare a generation familiar with accounting and marketing concepts, personal and family budgeting, and making informed decisions to improve their financial situations. This should become an integral part of their lives across different age stages. This aligns with the findings of the study by Dituri et al. (2019). The results favored females due to their commitment to education, family care, and guiding the youth towards conceptual building, truths, and educational principles that begin within the family and extend to the school. This approach trains students in expense rationalization, instilling financial culture at an early age, which contributes to the development of positive economic attitudes among learners. It helps them engage in economic behavior, understand the role of the economy in society, and enhance their ability to participate in economic activities, express opinions on economic issues, and propose appropriate solutions. This contribution strengthens their economic behavior and applies it in their daily lives, preparing them for the high school phase. Additionally, it fosters a sense of citizenship through fulfilling their duties in the community and preparing them to assume responsibility. Their role in schools is crucial, as they effectively plant the seeds of knowledge and reinforce information in learners from a young age, in ways that align with their developmental stages so that they can grow and progress with them, and this contributes to raising their level of awareness and helps them discover appropriate ways to manage money in terms of spending, saving, investing, and producing, as well as facing financial risks, and adopting rational economic behavior in the future. This aligns with the program "Riyali" launched by the Kingdom of Saudi Arabia through the Saudi Economic and Development Company (SEDCO) aimed at "education and promoting financial awareness," which is directed towards learners, in addition to various initiatives by the Saudi Arabian Monetary Authority to spread awareness and financial culture.

Recommendations

Based on the results obtained from the study, the researcher recommends the following***:***

The necessity of raising awareness among mathematics teachers about computational thinking skills and the concepts of financial culture included in middle school mathematics textbooks, and utilizing them during classroom situations in the teaching of mathematics.

The necessity of continuing professional development for mathematics teachers to take advantage of training programs designed to develop skills in teaching computational thinking and financial culture.

The necessity of employing modern teaching strategies to teach computational thinking skills and financial culture concepts, such as authentic learning, collaborative learning, project-based learning, game-based learning, scaffolding, storytelling, design-based learning, problem-solving strategies, and discovery learning.

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